

Claims

- [c1] 1. A flip chip light-emitting diode package, comprising:
a Schottky diode; and
a light-emitting diode, disposed on the Schottky diode by flip-chip bonding process, wherein the light-emitting diode and the Schottky diode are connected reverse and in parallel.
- [c2] 2. The flip chip light-emitting diode package of claim 1, wherein the package further comprises a plurality of solder bumps disposed between the Schottky diode and the light-emitting diode so that the Schottky diode and the light-emitting diode are connected reverse and in parallel.
- [c3] 3. The flip chip light-emitting diode package of claim 1, wherein the light-emitting diode further comprises:
a substrate;
a semiconductor layer, disposed on the substrate,
wherein the semiconductor layer at least comprises a first conductive type doped semiconductor layer, a second conductive type doped semiconductor layer and a light-emitting layer, and the light-emitting layer is disposed on the first conductive type doped semiconductor

layer and the second conductive type doped semiconductor layer is disposed on the light-emitting layer; a first electrode, disposed on the first conductive type doped semiconductor layer; and a second electrode, disposed on the second conductive type doped semiconductor layer.

- [c4] 4. The flip chip light-emitting diode package of claim 3, wherein material forming the first electrode is selected from a group consisting of Ti/Al, Cr/Au, Cr/Pt/Au, Cr/Pd/Au and Cr/Ti/Au.
- [c5] 5. The flip chip light-emitting diode package of claim 3, wherein material forming the second electrode is selected from a group consisting of Ni/Au, Pd/Au, Pt/Au, Ti/Au, Cr/Au, Sn/Au and Ta/Au.
- [c6] 6. The flip chip light-emitting diode package of claim 3, wherein the second electrode comprises an N-type transparent conductive oxide layer or a P-type transparent conductive oxide layer.
- [c7] 7. The flip chip light-emitting diode package of claim 3, wherein material constituting the N-type transparent conductive oxide layer comprises ITO or CTO.
- [c8] 8. The flip chip light-emitting diode package of claim 3, wherein material constituting the P-type transparent

conductive oxide layer comprises CuAlO_2 or SrCu_2O_2 .

- [c9] 9. The flip chip light-emitting diode package of claim 1, wherein the Schottky diode further comprises:
a submount having a first surface and a second surface;
an ohmic contact layer, disposed on a portion of the first surface and the second surface of the submount; and
a Schottky contact layer, disposed on a portion of the first surface of the submount, wherein the ohmic contact layer and the Schottky contact layer are electrically isolated.
- [c10] 10. The flip chip light-emitting diode package of claim 9, wherein the submount comprises an N-doped material.
- [c11] 11. The flip chip light-emitting diode package of claim 9, wherein the submount comprises a P-doped material.
- [c12] 12. The flip chip light-emitting diode package of claim 9, wherein material forming the submount is selected from a group consisting of Si, GaAs, GaP, GaN and ZnO.
- [c13] 13. The flip chip light-emitting diode package of claim 9, wherein material forming the ohmic contact layer comprises aluminum (Al).
- [c14] 14. The flip chip light-emitting diode package of claim

9, wherein material forming the Schottky contact layer is selected from a group consisting of titanium (Ti), nickel (Ni), gold (Au), tungsten (W), silver (Ag) and platinum (Pt).

- [c15] 15. A flip chip light-emitting diode package, comprising:
a Schottky diode group having a plurality of Schottky diodes, wherein the Schottky diodes are electrically connected in series, in parallel or in series and parallel together; and
a light-emitting diode disposed on one of the Schottky diodes by flip-chip bonding process, wherein the light-emitting diode and the Schottky diode group are connected reverse and in parallel.
- [c16] 16. The flip chip light-emitting diode package of claim 15, wherein the package further comprises a plurality of solder bumps disposed between one of the Schottky diodes and the light-emitting diode so that the Schottky diode and the light-emitting diode are connected reverse and in parallel.
- [c17] 17. The flip chip light-emitting diode package of claim 15, wherein the light-emitting diode further comprises:
a substrate;
a semiconductor layer, disposed on the substrate,
wherein the semiconductor layer at least comprises a

first conductive type doped semiconductor layer, a second conductive type doped semiconductor layer and a light-emitting layer, and the light-emitting layer is disposed on the first conductive type doped semiconductor layer and the second conductive type doped semiconductor layer is disposed on the light-emitting layer; a first electrode, disposed on the first conductive type doped semiconductor layer; and a second electrode, disposed on the second conductive type doped semiconductor layer.

[c18] 18. The flip chip light-emitting diode package of claim 17, wherein material forming the first electrode is selected from a group consisting of Ti/Al, Cr/Au, Cr/Pt/Au, Cr/Pd/Au and Cr/Ti/Au.

[c19] 19. The flip chip light-emitting diode package of claim 17, wherein material forming the second electrode is selected from a group consisting of Ni/Au, Pd/Au, Pt/Au, Ti/Au, Cr/Au, Sn/Au and Ta/Au.

[c20] 20. The flip chip light-emitting diode package of claim 17, wherein the second electrode comprises an N-type transparent conductive oxide layer or a P-type transparent conductive oxide layer.

[c21] 21. The flip chip light-emitting diode package of claim

17, wherein material constituting the N-type transparent conductive oxide layer comprises ITO or CTO.

[c22] 22. The flip chip light-emitting diode package of claim 17, wherein material constituting the P-type transparent conductive oxide layer comprises CuAlO_2 or SrCu_2O_2 .

[c23] 23. The flip chip light-emitting diode package of claim 15, wherein each Schottky diode further comprises:
a submount, having a first surface and a second surface;
an ohmic contact layer, disposed on a portion of the first surface and the second surface of the submount; and
a Schottky contact layer, disposed on a portion of the first surface of the submount, wherein the ohmic contact layer and the Schottky contact layer are electrically isolated.

[c24] 24. The flip chip light-emitting diode package of claim 23, wherein the submount comprises an N-doped material.

[c25] 25. The flip chip light-emitting diode package of claim 23, wherein the submount comprises a P-doped material.

[c26] 26. The flip chip light-emitting diode package of claim 23, wherein material forming the submount is selected from a group consisting of Si, GaAs, GaP, GaN and ZnO.

[c27] 27. The flip chip light-emitting diode package of claim 23, wherein material forming the ohmic contact layer comprises aluminum (Al).

[c28] 28. The flip chip light-emitting diode package of claim 23, wherein material forming the Schottky contact layer is selected from a group consisting of titanium (Ti), nickel (Ni), gold (Au), tungsten (W), silver (Ag) and platinum (Pt).